

Application No. 10/650,388
Response to Office Action

Customer No. 01933

R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Claim 1 has been amended to incorporate the subject matter of claim 7 whereby the cross-sectional shape of the optical glass element is polygonal.

In addition, claim 5 has been amended to add the missing phrases thereof. Amended claim 5 depends from claim 1 and recites that the mother glass has a cross-sectional area that is 5 to 150 times that of the optical glass element to be obtained, as supported by the disclosure in the specification at page 5, lines 30-32 and at page 11, line 27 to page 12, line 12. In this connection, moreover, it is noted that item 4 of the Office Action should have referred to claim 5 (instead of claim 6).

Still further, claim 8 has been amended to depend from claim 1, and claim 10 has been amended to correct a minor grammatical error.

No new matter has been added, and it is respectfully requested that the amendments to claims 1, 5, 8 and 10 be approved and entered.

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THE REJECTION OF CLAIMS 3, 4 and 12 UNDER 35 USC 112

The Examiner rejected claims 3, 4 and 12 under 35 USC 112 because they recite "BK7."

It is respectfully pointed out, however, that BK7 is a type of glass that is used by most leading optical manufacturers and that is well known in the art of manufacturing optical components. In this connection, it is respectfully pointed out that (at least) 52 issued U.S. patents recite BK7 in the claims, dating back to USP 4,368,957 issued January 18, 1983. And it is respectfully pointed out that (at least) 1,281 issued U.S. patents and 555 U.S. patent application publications mention BK7 in the specifications thereof, dating back at least to USP 3,946,150 issued March 23, 1976. Selected results of searches for BK7 in the USPTO patent and patent application full-text databases are attached.

In view of the extensive use of the term "BK7" in the specifications and claims of U.S. patents for more than 20 years, it is respectfully submitted that BK7 is clearly a definite term whose meaning is apparent to those of ordinary skill in the art, and it is respectfully requested that the Examiner withdraw the rejection of claims 3, 4 and 12 under 35 USC 112.

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THE PRIOR ART REJECTION

Claims 1, 2 and 5-11 were rejected under 35 USC 103 as being obvious in view of the combination of JP 10-001321 ("Hirota et al") and USP 5,155,631 ("Snyder et al"); and claims 3, 4 and 12 were rejected under 35 USC 103 as being obvious in view of the combination of Hirota et al, Snyder et al and USP 6,067,128 ("Imai"). These rejections, however, are respectfully traversed with respect to the claims as amended hereinabove.

According to the present invention as recited in amended independent claim 1, a method of manufacturing an optical glass element is provided which comprises preparing a mother glass having a cross-sectional shape substantially similar to a polygonal cross-sectional shape of the optical glass element, and drawing the mother glass while heating the mother glass to a predetermined temperature such that the mother glass has a viscosity of 10^5 to 10^9 poise.

With this technique, the flatness and smoothness of the surfaces of the optical glass element can be improved, the cross-sectional shape of the optical glass element can be made similar to that of the mother glass, and continuous production involving few steps can be carried out for the optical glass element.

By contrast, it is respectfully submitted that Hirota et al is directed to a method in which polyhedron glass optical

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elements are formed by precision press forming. That is, as described on page 2 of the Background of the Invention of the present application, Hirota et al is directed to a method of manufacturing a prism in which a rod-shaped glass element is prepared from a mother glass using a hot drawing method. The obtained rod-shaped glass element is then press-formed to obtain a long prism.

Thus, according to Hirota et al, round bars having a 40mm diameter and a 200mm length and consisting of a dense flint type optical glass and having a ground side face are set in the electric furnace 1 for fiber-pulling by a heat drawing method. A heater 2 heats the furnace 1 to about 600°C, and softens the tip 4 of the glass round bar 3. Then, according to Hirota et al, the softened glass round bar 3, having a viscosity of 10^6 to 10^7 poise, is pulled to obtain a round optical fiber 5 having a 0.5mm diameter. According to Hirota et al, the side of the fiber 5 is a defect-free smooth surface due to the pulling of the heat-softened round bar. Then, the fiber 5 is cut in increments of 20mm, to obtain glass materials to be subjected to molding are obtained. (See Fig. 1 and paragraph [0012] of the machine translation of Hirota et al.)

In order to form prisms according to Hirota et al, the ten preforms are set in a die and heated and compressed. After compression, the preforms are cooled slowly until the temperature

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is below the glass transition point, and the preforms are then rapidly quenched. According to Hirota et al, each of the obtained molded components is divided into 10 parts, and prisms 21 are obtained (see Figs. 2, 4, and 6 and paragraph [0014] of the machine translation of Hirota et al).

Thus, according to Hirota et al, prisms are obtained by first drawing a round mother glass into a round optical fiber. The round optical fiber is then molded to produce a long polyhedral body that is cut into prisms. Thus, according to Hirota et al, the mother glass (which is round) has a different shape from the prisms, which are polygonal.

By contrast, according to the present invention as recited in amended independent claim 1, the mother glass is prepared to have a cross-sectional shape substantially similar to a polygonal cross-sectional shape of the optical glass element.

Snyder et al, moreover, has been cited for the disclosure that "drawing conditions would vary greatly depending on the type of glass used" (page 3 of the Office Action). It is respectfully submitted, however, that Snyder et al merely discloses at column 6, lines 13-68 (referred to by the Examiner) that since the glass preform 20 should be heated to "at least a softening temperature," the temperature chosen for each glass will depend on the softening temperature of the glass.

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By contrast, as recited in claim 1 the mother glass is drawn while heating the mother glass to a predetermined temperature such that the mother glass has a viscosity of 10^5 to 10^9 poise. And as explained in the specification of the present application at page 13, lines 22-29, the predetermined temperature such that the mother glass has a viscosity of 10^5 to 10^9 poise is below the glass softening temperature.

In addition, it is respectfully pointed out that Snyder et al is directed to producing cylindrical micro lenses. Therefore, it is respectfully submitted that Snyder et al clearly does not disclose, teach or suggest a mother glass having a cross-sectional shape substantially similar to a polygonal cross-sectional shape of the optical glass element

With respect to claim 2, moreover, it is respectfully pointed out that Hirota et al discloses the preferred viscosity of the mother glass to be in the range of 10^6 to 10^7 poise during drawing. And it is respectfully submitted that Hirota et al does not at all disclose, teach or suggest the preferable viscosity range of 10^8 to 10^9 poise recited in claim 2.

Still further, it is respectfully submitted that Imai has merely been cited for the disclosure of a prism made from BK7, and it is respectfully submitted that Imai does not disclose, teach or suggest a method of producing the prism.

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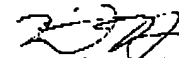
In view of the foregoing, it is respectfully submitted that the present invention as recited in amended independent claim 1, as well as claims 2-6, 8 and 10-12 depending therefrom, clearly patentably distinguishes over Hirota et al, Snyder et al and Imai, taken singly or in any combination under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,


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